and these expressions (31), (32) and (33) give for the roots of our numbers, in the case of the first problem, as follows:

$$\frac{m}{a}=\frac{12707211238697}{11011044931800};\ \frac{m}{b}=\frac{18687075351025}{11011044931800};\ \frac{m}{c}=\frac{23171973435271}{11011044931800}$$

In our second problem, the denominator of the expression for m must be negative, and this will be the case for $p=1$, for then we find $A=-389$, $B=-23$, $C=33$, and $D=37$; so that (31), (32) and (33) become

$$\frac{m}{a}=\frac{151321}{7863240};\ \frac{m}{b}=\frac{756605}{7863240};\ \frac{m}{c}=\frac{1059247}{7863240}.$$

If we take $p=-2$, our results will satisfy this second problem, also $p=-3$ will give answers. It will also be satisfied for $p=2$.

Remark.—On page 494, of Stoddard and Henkle's University Algebra, New York, Edition of 1861, our *first* problem is given. The answer is given by x^2, $25\,x^2$ and $49\,x^2$, in very large numbers, consisting of more than three times as many places of figures as in my numbers. The value of the root of the first number is there given

$$x=\frac{234081441488474293278391846859267419342225281}{2017764271514078196042928196999625135323O160}.$$

It is stated that these numbers were furnished by Prof. Daniel Kirkwood, and that he believed they were the smallest numbers which could be found. His method of solving the problem is not given.

I do not recollect ever having seen a solution of this *first* problem. In an Elementary Treatise on Algebra by John D. Williams, Boston, 1840, on page 413, he gives the solution of our *second* problem. He also proceeds in his solution by assuming x^2, $25\,x^2$ and $49\,x^2$ for the numbers, and obtains for his results the same numbers which I have given.

SOLUTION OF A PROBLEM.

BY PROF. O ROOT, HAMILTON COLLEGE, CLINTON, N. Y.

Problem.—"From a point in the circumference of a circular field a projectile is thrown at random with a given velocity, which is such that the diameter of the field is equal to the greatest range of the projectile; find the chance of its falling within the field."

Solution.—Take the given point as the origin, let the diameter of the circular field he represented by (a); put θ for any angle of elevation and ψ for the angle of azimuth so taken that when the projectile will fall on the circumference of the field we shall have $\psi = 2\theta$. Now since any por tion of the surface of a hemisphere whose radius is (a) (the diameter of the given circle) and whose center is at the given point is expressed by

$$a^2 \int\int \cos\theta \, d\,\theta \, d\,\psi,$$

therefore the favorable cases will be expressed by the integral

$$a^2 \int_0^{2\theta} d\,\psi \int_0^{\frac{\pi}{4}} \cos\theta \, d\,\theta,$$

and this divided by $\dfrac{\pi a^2}{\sqrt{2}}$ will give the chance required; therefore we have

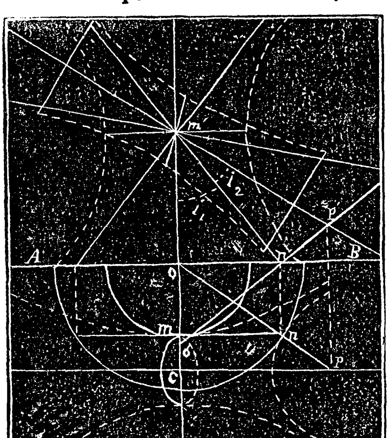
$$\frac{a^2 \int_0^{2\theta} d\,\psi \int_0^{\frac{\pi}{4}} \cos\theta \, d\,\theta}{\dfrac{\pi a^2}{\sqrt{2}}} = \frac{1}{2} - \frac{2}{\pi}(\sqrt{2} - 1)$$

for the chance that the projectile will fall on the circular field.

TANGENCY OF HYPERBOLOIDS OF REVOLUTION.

BY PROF. C. M. WOODWARD, ST. LOUIS, MO.

In his Applied Mechanics p. 430, under the head of skew-bevel wheels, Prof. Rankine says: "If two hyperboloids, equal or unequal be placed in the closest possible contact, they will touch each other along one of the generating straight lines of each which will form their line of contact."



This matter of tangency is stated without proper limitation, but the graphical method given later for finding the obliquities and the gorge circles of the required hyperboloids involves the condition of possibility of such a tangency, which I propose to deduce directly from two tangent hyperboloids by the methods of descriptive geometry.

Let r_1 and r_2 be the radii of the two gorge circles, and i_1 and i_2 the